Twist-beam axle for the rear suspension of a motor vehicle and method for its production

The present invention relates to a twist-beam axle for the rear suspension of a motor vehicle, as well as a method for the production of such a twist-beam axle.

It is known in the automotive field the use of rear suspensions in which the two rear wheels are interconnected by means of a twist-beam axle comprising basically a central cross-member compliant to torsion, which extends substantially transversely, and a pair of rigid trailing arms, attached to the ends of the cross-member, which support the rear wheels and provide the articulation of the axle to the vehicle body.

According to the prior art, the trailing arms of the twist-beam axle are formed as elongated integral bodies, for example of tubular shape, which are securely connected to the cross-member, for example by welding. Alternatively, a pair of trailing half-arms, that is, a front half-arm and a rear half-arm, respectively, may be provided for instead of a single trailing arm, wherein usually the rear half-arm is formed as a single piece with the cross-member whereas the front one is fixed to the cross-member, for example by welding. These known arrangements, which require a welded joint to be provided between the trailing arms, or the half-arms, and the cross-member, require a high dimensional and shape precision in the welding zones, in order to ensure the correct relative positioning of the parts to be connected and the strength of the welded connection.

A twist-beam axle according to the preamble of Claim 1 is known from EP-A-0 743 205. According to this known solution, each trailing arm comprises a pair of transversely inner half-shells, that is, a front half-shell and a rear half-shell, respectively, which are formed by prolongations of the respective end portion of the cross member, and a transversely outer half-shell securely connected to the pair of transversely inner half-shells so as to form therewith a structure having a closed cross-section.

is clearly understood that the non-described part is to be considered symmetric, or substantially symmetric, to that described.

By referring initially to Figures 1 to 4, a twist-beam axle for the rear suspension of a motor vehicle is generally indicated 10 and comprises a central cross-member 11 and a pair of trailing arms 12 fixed to respective side end portions 11a of the cross-member (in the figures only the left-hand end is shown).A bush 13 for articulation of the twist-beam axle 10 to the vehicle body is fixed to the front end of each trailing arm 12, whereas a mounting structure 14 for a wheel-carrier (not shown) and a sheet plate 15 intended to provide a lower support surface for a spring (also, not shown) are fixed to the rear portion of the arm 12, on the transversely outer side and the transversely inner side, respectively.

The middle portion of the cross-member 11, indicated 11b, has in its vertical plane of symmetry a cross-section of predetermined shape, in the illustrated example an omega-shape, adapted to provide the cross-member with the required elastic characteristics, in particular the compliance to torsion. The end portions 11a of the cross-member 11 form each a head wall 11c, downwardly inclined in the transverse direction, in which a hole 16 is provided for being passed through by a torsion bar 17 housed inside the middle portion 11b of the cross-member 11 and fixed at its ends to the trailing arms 12. Alternatively, the torsion bar 17 may be fixed to the head walls 11c of the side portions 11a of the cross-member, instead of being fixed to the trailing arms 12. Moreover, the middle portion 11b of the cross-member may assume obviously any other suitable shape, either open (as in the illus-

CLAIMS

1. Twist-beam axle for the rear suspension of a motor vehicle, comprising a central cross-member (11) and a pair of trailing arms (12) fixed to respective side end portions (11a) of the cross-member (11), wherein each trailing arm (12) comprises a pair of front and rear transversely inner half-shells (18, 19) fixed to the respective side end portion (11a) of the cross-member (11) and a transversely outer half-shell (20) securely connected to the transversely inner half-shells (18, 19) so as to form therewith a rigid body having a closed cross-section, characterised in that the transversely inner half-shells (18, 19) are separate components from the cross-member (11) and are securely connected to each other and to the respective side end portions (11a) of the cross-member (11).

2. Twist-beam axle according to Claim 1, characterised in that each of the transversely inner half-shells (18, 19) comprises a first essentially transverse limb (18a, 19a) which is securely connected to the respective side end portion (11a) of the cross-member (11) and to the other transversely inner half-shell (19, 18) of the same trailing arm (12), and a second essentially longitudinal limb (18b, 19b), integral with the first (18a, 19a), which is securely connected to the transversely outer half-shell (20) of the trailing arm (12).

3. Twist-beam axle according to Claim 2, characterised in that the first and second limbs (18a, 18b; 19a, 19b) of the transversely inner half-shells (18, 19) and the transversely outer half-shells (20) have, at least over part of their length, a substantially C-shaped cross-section, the upper and

lower horizontal walls of which form respective first joining edges (22, 23; 24, 25; 26, 27), facing two by two, for connection of the front and rear transversely inner half-shells (18, 19) to each other and to the transversely outer half-shell (20).

4. Twist-beam axle according to Claim 2, characterised in that the first limbs (18a, 19a) of each pair of transversely inner half-shells (18, 19) form, on the transversely inner side, respective second joining edges (21) for connection of the said half-shells to the respective side end portion (11a) of the cross-member (11).

5. Twist-beam axle according to any of the preceding claims, characterised in that the half-shells (18, 19, 20) of each trailing arm (12) are securely connected to each other by welding and in that the transversely inner half-shells (18, 19) of each trailing arm (12) are securely connected to the respective side end portion (11a) of the cross-member (11) by welding.

6. Twist-beam axle according to Claims 3 and 5, characterised in that in the said first facing joining edges (22, 23) for connection of the front and rear transversely inner half-shells (18, 19) to each other are spaced apart by a gap filled by a welding bead.

7. Twist-beam axle according to any of the preceding claims, characterised in that the cross-member (11) has, in its vertical plane of symmetry, an omega-shaped cross-section.

8. Twist-beam axle according to Claim 7, characterised in that it comprises also a torsion bar (17) housed inside the cross-member (11) and fixed at its ends to the transversely outer half-shells (20) of the trailing arms (12).

9. A method for the production of a twist-beam axle (10) for the rear suspension of a motor vehicle, comprising the steps of:

a) providing a cross-member (11) having side end portions (11a) adapted to engage a pair of trailing arms (12);

b) providing, for each side end portion (11a) of the cross-member (11), a pair of front and rear transversely inner half-shells (18, 19) adapted to be securely connected to each other and to the side end portion (11a) of the cross-member (11), and a transversely outer half-shell (20) adapted to be securely connected to the pair of transversely inner half-shells (18, 19) so as to form therewith a rigid body of closed cross-section;

c) securely connecting the pairs of transversely inner half-shells (18, 19) onto the respective side end portions (11a) of the cross-member (11);

d) securely connecting the transversely outer half-shells (20) onto the respective pairs of transversely inner half-shells (18, 19).

10. Method according to Claim 9, characterised in that the step b) comprises the operation of forming both the front and rear transversely inner half-shells (18, 19) in such a way

that they comprise each a first essentially transverse limb (18a, 19a) adapted to be securely connected to the respective side end portion (11a) of the cross-member (11) and to the other transversely inner half-shell (19, 18) of the same trailing arm (12), and a second essentially longitudinal limb (18b, 19b), integral with the first (18a, 19a), adapted to be securely connected to the transversely outer half-shell (20) of the trailing arm (12),
wherein the said first and second limbs (18a, 18b; 19a, 19b) of each pair of transversely inner half-shells (18, 19) and each transversely outer half-shell (20) have, at least over part of their length, a substantially C-shaped cross-section, the upper and lower horizontal walls of which form respective first joining edges (22, 23; 24, 25; 26, 27), adapted to be disposed facing two by two for connection of the front and rear transversely inner half-shells (18, 19) to each other and to the transversely outer half-shell (20), and
wherein the first limbs (18a, 19a) of each pair of transversely inner half-shells (18, 19) form, on the transversely inner side, respective second joining edges (21) for connection of the transversely inner half-shells to the respective side end portion (11a) of the cross-member (11).

11. Method according to Claim 10, characterised in that the steps c) and d) comprise the operation of welding the said first and second joining edges (22, 23; 24, 25; 26, 27; 21).

ABSTRACT

Twist-beam axle for the rear suspension of a motor vehicle and method for its production

The twist-beam axle (10) comprises a central cross-member (11) compliant to torsion and a pair of trailing arms (12) fixed to side end portions (11a) of the cross-member (11) for articulated connection of the axle to the vehicle body and for support of the rear wheels. Each trailing arm (12) is formed by a pair of first, transversely inner half-shells (18, 19), that is, a front half-shell and a rear half-shell, respectively, securely connected to each other and to the respective end (11a) of the cross-member (11), and by a second transversely outer half-shell (20), securely connected to the pair of first half-shells (18, 19) so as to form therewith a structure having a closed cross-section.